# SHORTER ARTICLES AND DISCUSSION

## THE CAUSE OF THE BELIEF IN USE INHERITANCE

THIS note expresses an effort to view the old and recurring problem of use inheritance from the aspect of the underlying motives of thought involved instead of through a consideration of the evidence directly bearing upon it.

The heredity of acquired traits is, theoretically, biological heresy. But the interminable cropping out of the belief even in professional circles indicates a strong psychological impulse toward the conviction. The mainspring of this impulse thus becomes a matter of some importance to the student of heredity.

To begin with, it is well known that the lay public almost without exception takes use inheritance for granted. Even evolution, in the real mental workings of most educated but unprofessional people, is more generally explained, unconsciously and in concrete cases, by appeal to the machinery of use inheritance than to that of selection. The phrases struggle for existence and survival of the fittest have indeed evoked a wide popular response on account of their picturesqueness, but their concepts are still but little employed, even in the intelligent and studied folk mind, as a real means of understanding or explaining evolution.

Those sporadic but in the aggregate numerous biologists who adhere to the doctrine of use inheritance, revert to it, or evince symptoms of a leaning toward it, may be divided into two types. The first class, probably because they think more penetratingly than the average, long ago perceived the inadequacy of selection alone as an explanation of organic evolution; and more lately perceive also the insufficiency of selection with mutations and Mendelian phenomena superadded. To students of this type, use inheritance is therefore merely a last resort, a hypothesis on which they fall back in default of any other to stop a logical gap. The only methodological criticism that can be made of this school is that it would undoubtedly be more stimulating of new discovery if we were frankly to avow the limits of our knowledge and leave certain things unexplained, than to complete the mental structure of evolution by piecing in a principle which admittedly rests only on contested facts and has opposed to it about as large a body of evidence as can be assembled on behalf of any negative and therefore logically unprovable proposition.

The second class consists of biologists and utilizers of biological material whose keenness of thought is below the average. This school introduces use inheritance into the conception of evolution because it has failed to comprehend adequately the essential problems of evolution, and approaches them substantially in the attitude of the layman.

The latter class is therefore merely unscientific and popular in its thought processes; the former, having exhausted scientific means and found them inadequate, returns, more or less frankly in despair, to current folk opinion. The problem accordingly is to discover the basis of the deeply rooted popular notion that is involved in both cases.

While never formulated into a definite working principle until Lamarck, because of the world's lack of specific scientific interest in organic phenomena, the principle of use inheritance has nevertheless been tacitly assumed by civilized nations of all periods, and is taken as self-evident even by savages. It must therefore rest on a large mass of common experience interpreted by an elementary process of thought. Such an elementary process—in fact the only elementary process of wide scope—is analogy.

The question then becomes what may be the basis—real enough though unscientifically employed—for the analogizing that has resulted in the conviction that use heredity exists. There must evidently be a broad group of phenomena in human experience that bear some resemblance to the hereditary transmission of the acquired.

These phenomena are the exceedingly common ones of social inheritance or cultural transmission and growth. We do "inherit" a name, or property, or knowledge of a language, or the practice of an art, or belief in a particular form of religion. Biologically such "inheritance" is of course absolutely distinct from "heredity" because the mechanism of transmission is different. The source of social inheritance is not restricted to parents and actual ancestors in the line of descent, but embraces a multitude of individuals, consanguineous and unrelated, dead, living, and sometimes even junior to the inheritors; in other words, the totality of the social environment, past and present, of an individual. We can and do "inherit" property from an uncle, our "mother tongue" from a nurse, the arithmetic evolved by past ages from a schoolmaster, our dogmas and philosophy from a prophet, our political and moral beliefs from the whole circumambient public opinion.

As this social or cultural transmission concerns human beings, it is of more immediate interest to the normal unschooled mind than the transmission which gives organs, instincts and peculiarities to animals and plants. It is therefore recognized much sooner than the processes which guide biological or organic transmission. It needs no proof that in his development man was concerned far earlier with himself than with animals or other parts of nature. It is well known, for instance, that the animism which is accepted as the basis of all religion, anthropomorphizes not only its gods and the vaguer forces of nature, but especially animals, plants and objects.

It is only recently, accordingly, that the world has paid any true attention to organic heredity, whereas since the beginning of human existence there has been recognition of social inheritance. History, the science of human society, is, even in a relatively advanced form, several thousand years old, and as a rudiment has enough interest to appeal to savages. Biology, the science of the organic, has an age of barely two centuries.

It is significant that the first theory of organic evolution, that of Lamarck, resorted wholly to the explanation of use inheritance borrowed from social inheritance. A second stage was reached when Darwin introduced the organic factor of selection, though refusing to break with the older explanation. A last phase was inaugurated when Weismann insisted that organic phenomena must be interpreted solely by organic processes.

The priority of reasoning by analogy over reasoning by means of a specific mechanism is a world-wide historical phenomenon. The two modern views of evolution and creation are found as crude cosmic philosophies in the mythologies of the most primitive savages, as well as in the thinking of Hindus, Semites, Greeks, and Romans. But they occur, one as an analogy with the familiar phenomenon of manufacture or making of objects by hand, the other as an analogy with the equally familiar phenomena of birth and growth. What modern science has done is to adopt these age-old and crude ideas, as it has adopted the half-mythologic concepts of the atom and ether, and put them to new use. Only the uneducated think of Darwin as the originator of the doctrine of evolution. What he originated was an organic and in his day new mechanism, by which the old concept of evolution could be explained and therefore supported.

The distinction between the social and the organic is far from

a novel one. But the two groups of phenomena, and the processes involved in each, are still very frequently confounded in other domains than that of use inheritance. The whole eugenics movement, for instance, so far as it is a constructive program and not a mere matter of ordinary practical prophylactic social hygiene, rests upon the assumption that social progress can best be accomplished by organic means. It may be rash to deny wholly that such an end can be achieved in this way or that it would be useful. But the orthodox eugenist, from the time of the founder Galton, has consistently and complacently made this assumption without any inquiry as to its justification. Lamarck erected a false doctrine of evolution through explaining the organic in terms of the social, or in terms derived by mere analogy from the social. The eugenists of to-day, it may fairly be suggested, bid fair to vitiate a movement that springs from the most sincere of motives, by resting its basis on an interpretation of the social as merely organic.

In summary, the doctrine of the hereditary transmission of acquired characters is no more disprovable than it is provable by accumulation and analysis of evidence. It springs from a naïve, unscientific, and even primitive method of reasoning by analogy, which in this case works to a confusion of the long-distinguished and necessarily distinct concepts of the organic and the social. The doctrine must therefore be dismissed on purely methodological grounds. It is possible that when the missing factor or element of evolution is discovered that neither Darwin nor the mutationists have been able to find, this factor will prove to be something superficially similar to use inheritance. But it will differ from the present only half-discredited but discreditable factor of heredity by acquirement, in containing an organic mechanism, and will therefore be essentially different from this crude and confused assumption.

A. L. KROEBER.

UNIVERSITY OF CALIFORNIA

## TRIFOLIUM PRATENSE QUINQUEFOLIUM

HUGO DE VRIES in his mutation theory tells us in detail about his production, by means of selection from two mutant forms, of a five-leaved race of red clover. This race he called *Trifolium pratense quinquefolium*. The two plants obtained for starting